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This system of stations would be :—

| | Lat. | Long. | Difference. Lat. | Difference. Long. |
|---|---|---|---|---|
| | ° ′ | ° | ° ′ | ° ′ |
| Sydney ... | −33 52 | −151·2 | | |
| | | | 0 4 | 132 7 |
| Cape of Good Hope | −33 56 | − 18·5 | | |
| | | | 0 2 | 89 2 |
| Santiago (30 m. S.) | −33 54 | + 70·7 | | |

There are other grounds which make the establishment of such a belt in the southern hemisphere desirable. The phases of the annual term of the polar motion occur there in opposite climatic conditions to those in the northern belt.

The fact that two English colonial observatories are so fortunately situated, on the same parallel and in such advantageous difference in longitude, seems to make it appropriate that the Society should deliberately consider this proposition and, if it commends itself to them, lend their influence and encouragement to the undertaking of it under national auspices.

S. C. Chandler.

The foregoing letter was considered at the meeting of the Council of the Royal Astronomical Society (1903 March 13), and the following resolution was passed :—

That the Council of the Royal Astronomical Society is much impressed with the importance of establishing a Southern Belt of Latitude stations for two years at Sydney, the Cape of Good Hope, and near Santiago as proposed by Mr. Chandler, to investigate the subject of Mr. Kimura's term in the latitude variation, and considers it very desirable that this proposal should be carried into effect.

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## *Velocity in the Line of Sight. Selected Stars. Cambridge Observatory, I.* 1902. By H. F. Newall.

The present note is a first contribution to the plan of cooperation recently inaugurated under the initiative of Professor E. B. Frost, of the Yerkes Observatory (*Astrophysical Journal*, 1902 October, xvi. 169), and contains (i) a brief statement of the instruments used at Cambridge ; (ii) notes as to the measurement of photographs and the reduction of results ; (iii) a few results relating to the velocity in the line of sight of three out of the ten stars selected for the purposes of co-operative observations as velocity-reference-stars.

If apology is needed for the presentation of such meagre results, it may be offered on the ground that it seems desirable

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to publish results for a given year as early as convenient after the end of the year; and though the year 1902 was already well advanced before the plan of co-operation was really inaugurated, there is some advantage in publishing even meagre results at once, in the hope that the collation of the first contributions of the co-operating observatories will lead to the evolution of a form of publication best suited for the purpose in time for the more complete results of 1903.

The following notes summarise a description of the instruments used:—

*Instruments*:—

Equatorial: Aperture 25 inches (630 mm.), focal length 29 feet (8844 mm.). Used with correcting lens which changes the angular aperture of the convergent beam from $\frac{1}{14}$ to $\frac{1}{10}$, and effectively reduces focal length to 21 feet.

Spectrograph: Slit, reflecting speculum jaws after device of Huggins.

Collimator, aperture $2\frac{1}{8}$ inches (54 mm.), focal length $20\frac{1}{2}$ inches (520 mm.).

Prisms, four, flint, transmitting a 2-inch beam, deviation 180° for $H_\gamma$.

Camera, focal length 20 inches (508 mm.).

Temperature control, instrument encased in quilted cover; no electrical heating at present (1903 January).

*Measurement of Photographs.*—Zeiss Comparator, one revolution of micrometer corresponds effectively to $\frac{1}{10}$ mm. Errors of scale have been carefully determined and are applied in all reductions.

The plates are measured in two positions: (i) red to right (R to *r*), (ii) red to left (R to *l*). In the position "red to right" the scale readings increase with increasing wave-lengths.

The scale of the photographed spectra and the values of a single turn of the micrometer screw are indicated in the following table:—

| Wave-length. | Tenthmetres per millimetre. | Velocity km/sec per turn of micrometer. |
|---|---|---|
| 4200 | 12·2 | 87 |
| 4250 | 13·1 | 92 |
| 4300 | 13·9 | 97 |
| 4350 | 14·7 | 101 |
| 4400 | 15·6 | 106 |

*Reductions.*—Wave-lengths of stellar lines are determined with reference to comparison spectrum of Fe spark, by means of Cornu-Hartmann relation. Hence shift due to velocity &c. is found, $\delta\lambda = \lambda_{*} - \lambda_{\odot}$.

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*Tables and Standards.*—Kayser's wave-lengths are used for comparison lines at present ; but as the spark is used, special determinations will be necessary.

Rowland's tables for the solar spectrum are used for the values of $\lambda_\odot$.

Schlesinger's tables for correction for Earth's orbital velocity (Sun's parallax, 8″·80), and a modification of Campbell's tables for correction for Earth's diurnal motion. Velocity of light, 300,000 km/sec.

*Results.*—The velocity given for each photograph referred to in the following table is the velocity of the star with reference to the Sun. It is expressed in kilometres per second, and is corrected for the orbital velocity of the Earth and for its diurnal motion, and also for the curvature of the spectrum lines, but otherwise is the simple arithmetic mean of the values determined for the various lines measured in the spectrum.

| Star and No. of Plate. | Date and G.M.T. | | Hour Angle. | Slit Width. | Range of Spectrum used. | Comparison Spectrum. | No of * lines. | Velocity reduced to Sun. |
|---|---|---|---|---|---|---|---|---|
| **α Arietis.** 1902 | | | | | | | | |
| | | h m | h m | mm | | | | km/sec. |
| F. 346 | Sep. 16 | 12 17 | 21 51 | 0·025 | 4202<br>4405 | Fe spark | 17 | −13·44 |
| F. 353 | Sep. 26 | 11 17 | 21 34 | ,, | ,, | ,, | 17 | −16·02 |
| F. 374 | Nov. 12 | 10 29 | 23 54 | ,, | ,, | ,, | 17 | −13·23 |
| | | | | | **Mean** (3 photographs) | | | **−14·26** |
| **α Persei.** 1902 | | | | | | | | |
| | | h m | h m | mm | | | | |
| F. 349 | Sep. 19 | 13 2 | 21 37 | 0·025 | 4250<br>4326 | Fe spark | 12 | −3·14 |
| F. 351 | Sep. 24 | 12 54 | 21 49 | ,, | ,, | ,, | 13 | −1·89 |
| F. 352 | Sep. 25 | 11 55 | 20 53 | ,, | ,, | ,, | 13 | −1·83 |
| F. 356 | Sep. 30 | 11 27 | 20 47 | ,, | ,, | ,, | 13 | −6·24 |
| F. 357 | Oct. 2 | 10 40 | 20 6 | ,, | | | 13 | −1·48 |
| F. 360 | Oct. 15 | 8 52 | 19 9 | ,, | | | 13 | −0·57 |
| F. 361 | Oct. 15 | 9 52 | 20 9 | ,, | | | 13 | −2·32 |
| F. 363 | Oct. 18 | 10 32 | 21 1 | ,, | | | 13 | −4·72 |
| F. 364 | Oct. 22 | 9 42 | 20 27 | ,, | | | 13 | −1·22 |
| F. 365 | Oct. 22 | 10 52 | 21 37 | ,, | | | 13 | −2·96 |
| F. 367 | Nov. 8 | 9 37 | 21 29 | ,, | | | 13 | −1·86 |
| F. 371 | Nov. 12 | 7 45 | 19 51 | ,, | | | 13 | −2·68 |
| F. 372 | Nov. 12 | 8 35 | 20 41 | ,, | | | 13 | −4·37 |
| F. 373 | Nov. 12 | 9 14 | 21 20 | ,, | | | 13 | −1·31 |
| | | | | | **Mean** (14 photographs) | | | **−2·61** ± 0·28 |
| | | | | | p.e. of single determination | | | ± 1·04 |

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| Star and No. of Plate. | Date and G.M.T. | | | Hour Angle. | | Slit Width. | Range of Spectrum used. | Comparison Spectrum. | No of * lines. | Velocity reduced to Sun. |
|---|---|---|---|---|---|---|---|---|---|---|
| **α Bootis.** | 1902 | | | | | | | | | |
| | | h | m | h | m | mm | | | | km/sec. |
| F. 334 | May 13 | 13 | 5 | 2 | 17 | 0·0084 | 4202<br>4326 | Fe spark | 13 | −4·81 |
| F. 336 | June 9 | 12 | 40 | 3 | 39 | „ | „ | „ | 14 | −5·44 |
| F. 337 | June 9 | 13 | 50 | 4 | 49 | „ | „ | „ | 14 | −7·53 |
| F. 338 | June 17 | 11 | 0 | 2 | 27 | „ | „ | „ | 14 | −4·87 |
| F. 339 | June 23 | 11 | 10 | 3 | 4 | „ | „ | „ | 7 | −5·83 |
| F. 341 | July 9 | 11 | 11 | 4 | 8 | „ | „ | „ | 13 | −6·31 |

**Mean** (6 photographs) **−5·80** ± 0·28

p.e. of single determination ± 0·68

*Accuracy of Measurements.*—In order to convey some idea as to the accuracy attained in the measurements, particulars of results of the reduction of plate F. 334 *α Bootis* are here given, with reference to twelve lines that were picked out in the comparison spectra of the iron spark and measured just as if they were to be used as standard lines, and also with reference to seventeen lines measured in the spectrum of the star. This plate was measured by myself * altogether four times, twice in each position of the plate, red to right (R to *r*) and red to left (R to *l*). The measurements of the iron lines and the star lines are dealt with separately, and by the term "completely independent sets of measures" it is intended to convey that (i) the plate was adjusted afresh each time on the micrometer for parallelism both of the spectrum to the slide and of the bisecting wire to comparison lines, and also for focus of the eyepiece, and (ii) the measurements were carried out on different days, so that all question of remembering appearances of individual peculiarities in the photographic images is eliminated.

A. *Comparison lines :*

(1) From two completely independent sets of measures, each R to *r*, differences were taken between the measures on each line.

The mean error of a single difference is $\pm0^{\mathrm{mm}}{\cdot}00089$.

Hence the mean error for a single line taken as the mean of two separate measures is $\pm0^{\mathrm{mm}}{\cdot}00045$.

Similar results are got from two completely independent sets of measures, each R to *l*.

(2) Next, from two independent sets of complete measures, each being the mean of a measure R to *r* and a measure

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* My assistant, Mr. H. J. Bellamy, who has secured all the photographs from which the results recorded in this note have been got, has also measured the plates of α Bootis with results which are in good accord with my own; but I confine myself in the present note to my own measurements for the sake of uniformity, and propose to revert to a comparison of our results in another paper, which is to contain a description of the four-prism spectroscope.

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R to *l*, differences were taken between the complete measures on each line.

The mean error of a single difference is $0^{mm}\cdot00079$.

The mean error for a single line taken as the mean of two measures R to *r* and R to *l* is $\pm 0^{mm}\cdot00056$.

B. *Star lines:*

(3) From two completely independent sets of measures, each R to *r*,

The mean error for a single line taken as the mean of two measures, each R to *r*, is $\pm 0^{mm}\cdot00075$.

(4) From two completely independent sets of measures, each R to *l*,

The mean error for a single line is $\pm 0^{mm}\cdot00051$.

(5) From two independent sets of complete measures, each being the mean of a measure R to *r* and a measure R to *l*,

The mean error for a single line taken as the mean of two measures R to *r* and R to *l* is $\pm 0^{mm}\cdot00058$.

Taking the extreme values of a turn of the micrometer in the range of spectrum measured as 87 $^{km}/_{sec}$ at the violet end and 99 $^{km}/_{sec}$ at the red end, we find from (2) and (5) that the probable error of a complete measure lies

for a single comparison line between $\pm 0\cdot32$ and $\pm 0\cdot37$ $^{km}/_{sec}$
and for a single star line between $\pm 0\cdot33$ and $\pm 0\cdot38$ $^{km}/_{sec}$.

The above results relate simply to settings of the micrometer wire on the lines, and are independent of any question of identification of lines. The peculiarities of what may be called right and left personality are eliminated.

Each of the four sets of measures of F. 334 has been reduced separately, and a velocity has been deduced for each of the 13 star lines used for reduction. Combining them in pairs so as to eliminate right and left personality, we get the probable error of a velocity determined from a single line as $\pm 1\cdot3$ $^{km}/_{sec}$ for one pair of measures, and $\pm 1\cdot4$ for the other, whilst the probable errors of the final means are $\pm 0\cdot36$ and $\pm 0\cdot38$ $^{km}/_{sec}$. The value obtained in this way is probably only serviceable as a measure of success in identification of the stellar lines.

If we take the mean velocity for each of the six photographs of *α Bootis* that have been measured, and give equal weight to each as a separate independent observation, we arrive at a more trustworthy value of the probable error of the velocity based on measurements of a single photograph, viz. $\pm 0\cdot68$ $^{km}/_{sec}$.

*Note on the Spectrum of α Bootis.*—In the measurements of the spectra of *α Bootis*, eighteen lines were picked out for measurement in the range of spectrum dealt with, viz. λ 4202—λ 4325. On reduction four of these lines showed peculiarities and were omitted for the purposes of this note. They are evidence either

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of peculiar conditions in the star or of the superposition of a second spectrum on the main one. Further measurements and observations have been planned with a view to elucidating the point.

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## *On the Nebula h 2302 N.G.C. 7822 Cassiopeiæ; the Region surrounding H II. 457 N.G.C. 1665 Eridani, with ten new nebulæ; and H III. 558 N.G.C. 7492 Aquarii.* By Isaac Roberts, D.Sc., F.R.S.

The nebula *h* 2302 is described by Sir John Herschel in the *Phil. Trans.* 1833 November, p. 481, as exceedingly faint, of a round figure, diam. 10′±.

Three photographs of the nebula and of the region surrounding it were taken with the 20-inch reflector and exposures of the plates during 90 minutes each, 1901 October 9, 1902 October 25, and 1902 December 2. They show the nebula to be a cloud of very faint nebulosity, irregular in light intensity and structure; the stars DM. 1679, zone 66°, mag. 6·0, DM. 1676, zone 66°, mag. 7·8, and DM. 1675, zone 66°, mag. 9·0, which is the brightest in a cluster of bright and faint stars, are, apparently, involved in the nebulosity. The cloud measures about 42′ of arc from *preceding* to *following* and 38′ from *north* to *south*; there are also faint indications, on the negative, of further extensions of the nebulosity which a longer exposure of the plate would reveal with greater density.

The region around the nebula H II. 457 *Eridani* N.G.C. 1665 includes many nebulæ, amongst which are the following prominent ones:—H II. 457 is shown on the photograph taken with the reflector 1903 February 17, to be a right-hand spiral viewed obliquely, nucleus stellar; these features are not recorded by Herschel.

H III. 589 N.G.C. 1659. The photograph shows this nebula to be a spiral with bright stellar nucleus; very faint star involved in the *north following* end; these features are not recorded by Herschel.

H III. 588 N.G.C. 1643 is described by Herschel as extremely faint; very small; irregularly round; brighter in the middle. The photograph shows it to be bright and pretty large.

*h* 330 N.G.C. 1656. Sir J. Herschel describes this nebula as extremely faint; irregular figure? The photograph shows it like a large stellar nucleus with extensions of faint nebulosity in *south following* to *north preceding* direction; a faint star near it on the *n.f.* side.

N.G.C. 1645. D'Arrest describes it as very faint; pretty small; round. The photograph shows it like a pretty bright star surrounded by nebulosity.